Annual Highlights 2018-2019

Reef & Rainforest
RESEARCH CENTRE

Green sea turtle (*Chelonia mydas*) swimming slowly over a degraded reef on the Great Barrier Reef. Photo: Suzanne Long

Contents

From the Board

The Reef and Rainforest Research Centre (RRRC) is an enterprising Australian-based not-for-profit consortium of members with common interests in the conservation and sustainable development of tropical Australia and beyond. For over a decade we have been managing and delivering the science needed to inform and implement improvements in the way our members, partners and stakeholders use and look after our natural resources and the communities that depend upon them.

Welcome to our annual highlights publication for 2018-19, briefly showcasing some of RRRC's major activities and considerable achievements throughout this period. These include:

- Continued successful management and delivery of the National Environmental Science Program's Tropical Water Quality Hub, which has invested in 82 projects to date and involves 220 researchers from six partner research institutions
- Ongoing application of science-based integrated pest management principles to control crown-of-thorns starfish continued to demonstrably save live coral cover across 42 high-value priority reefs
- Completion of the Reef 2050 Traditional Owners (TO) Aspirations project, which was TO-led and has already delivered better understanding of aspirations for the protection and management of the Great Barrier Reef. This project concluded this year on-time and on-budget, and the new knowledge was repatriated back to GBR Traditional Owners.
- Working with our marine tourism partners to collect ~400 million measurements of water temperature and flow and enhance understanding of the fine-scale hydrodynamics during "coral bleaching weather", through the Reef Havens Research Project platform at Moore Reef
- Continued success in the Treaty Villages of Papua New Guinea building community capacity and the ongoing Ranger Program, including the development of several micro-businesses that are beginning to provide economic opportunities for these challenged communities on Australia's border.

This year also saw a number of Board members' terms reach completion, including that of Chair Dr Ian Poiner who took up the role of Chair of the Great Barrier Reef Marine Park Authority in March 2019. Ian's term as our Chair has been a period of activity and prosperity and we wish him well in his new role. Deputy Chair Russell Beer took on the role of Acting Chair in the interim. In addition the RRRC board was pleased to welcome Dr Liz O'Brien and Mr Alan Wallish as new directors in 2018-19. We thank them for their valuable expertise and commitment to the consortium.

RRRC's key skill is centred around being able to translate the latest scientific research into improved environmental and social outcomes. Our programs and associated research site range in location from South East Queensland to the Treaty Villages in Southern PNG and our products are being used by over 80 organisations, including the Australian Government, Papua New Guinea Government, regional natural resource management groups, local government, industry (tourism, agriculture, and fisheries), various conservation organisations, and Indigenous bodies.

Juvenile blacktip reef shark (*Carcharhinus melanopterus*) hunting fish in the shallows, Fitzroy Island. Photo: Suzanne Long

Chair & Directors 2018-2019

Dr Ian Poiner, *Chair*
(resigned 27th October 2018)

Mr Russell Beer, Deputy Chair

Ms Sheriden Morris, *Managing Director & Company Secretary*

Dr Andrew Ash

Dr Paul Hardisty

Prof Marcus Lane
(*resigned 8th November 2018*)

Mr Stan Lui

Mr Col McKenzie
(*resigned at the AGM on 9th November 2018*)

Mr Alan Wallish
(*appointed at the AGM on 9th November 2018*)

Dr Liz O'Brien
(*appointed at the AGM on 9th November 2018*

Members of the RRRC Consortium

James Cook University (JCU)

Australian Institute of Marine Science (AIMS)

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Griffith University (GU)

Association of Marine Park Tourism Operators Limited (AMPTO)

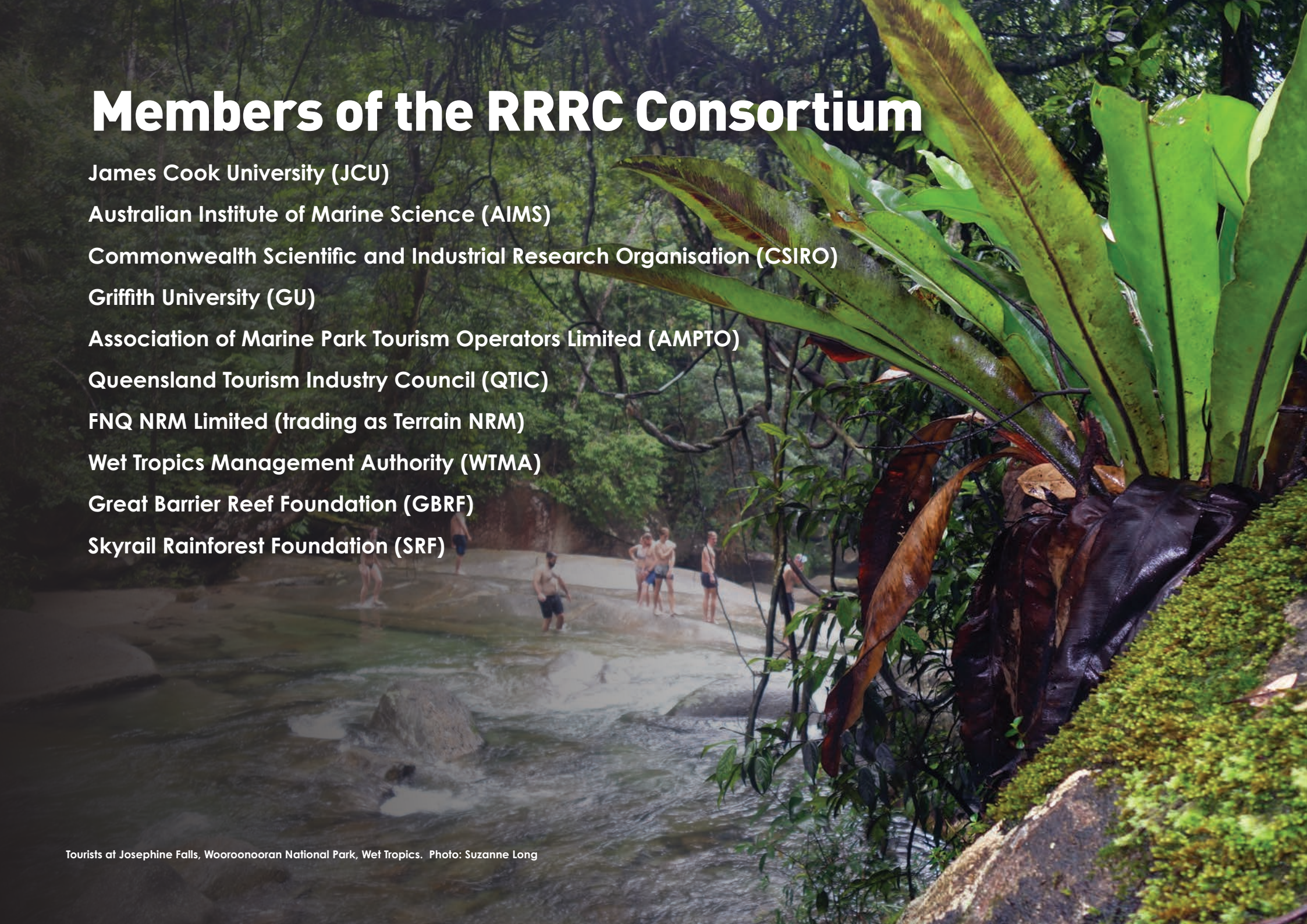
Queensland Tourism Industry Council (QTIC)

FNQ NRM Limited (trading as Terrain NRM)

Wet Tropics Management Authority (WTMA)

Great Barrier Reef Foundation (GBRF)

Skyrail Rainforest Foundation (SRF)



Tourists at Josephine Falls, Wooroonooran National Park, Wet Tropics. Photo: Suzanne Long

JAMES COOK UNIVERSITY AUSTRALIA

QUEENSLAND TOURISM INDUSTRY COUNCIL
The Voice of Tourism

AMPTO
Association of Marine Park Tourism Operators

Australian Government

AUSTRALIAN INSTITUTE OF MARINE SCIENCE

CSIRO

Skyrail rainforest foundation

GREAT BARRIER REEF foundation

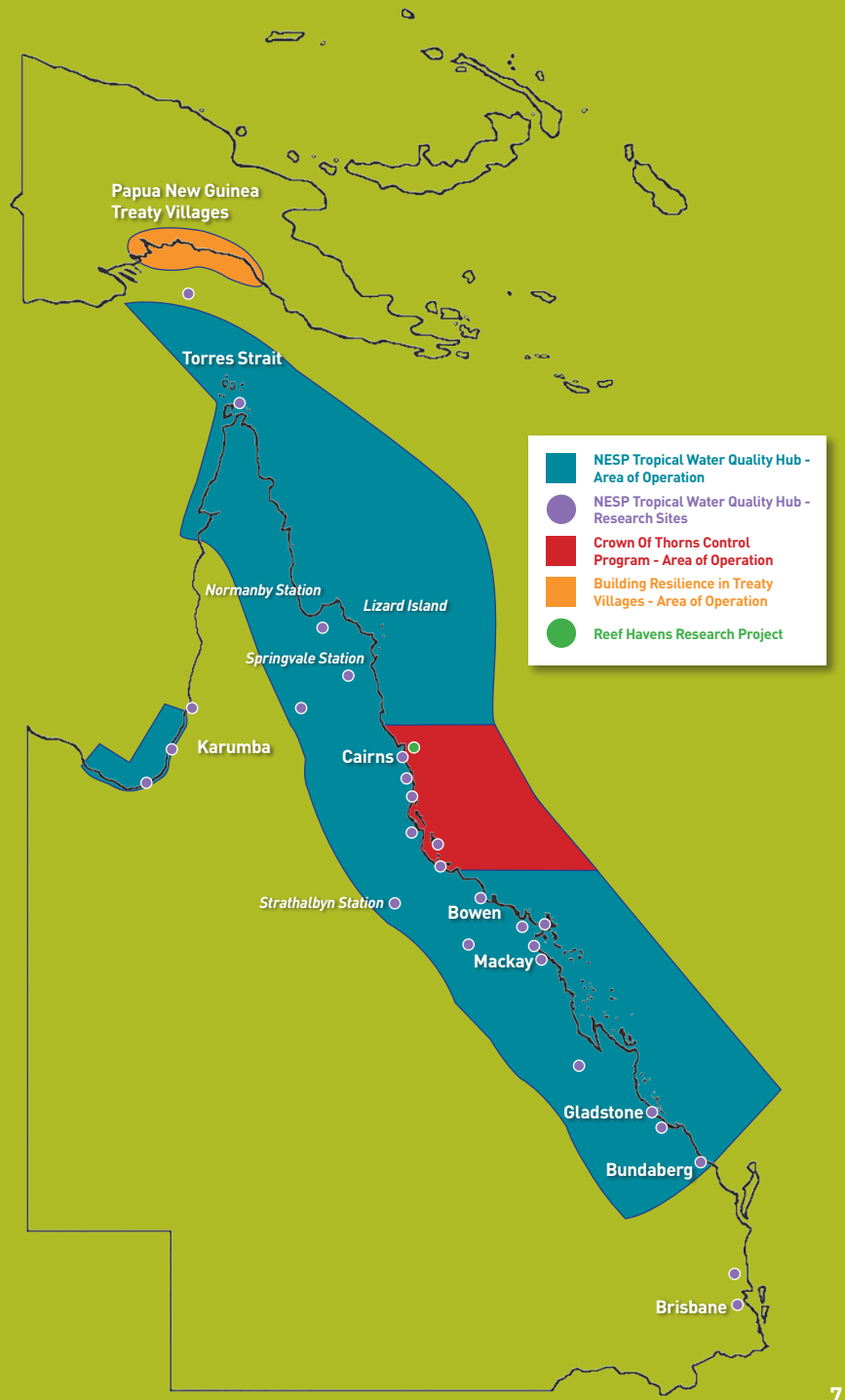
WET TROPICS MANAGEMENT AUTHORITY

terrain
NATURAL RESOURCE MANAGEMENT

Griffith UNIVERSITY

Our Programs

In 2018-19 the RRRC administered, led and/or hosted five major programs and a number of other smaller projects across the region.

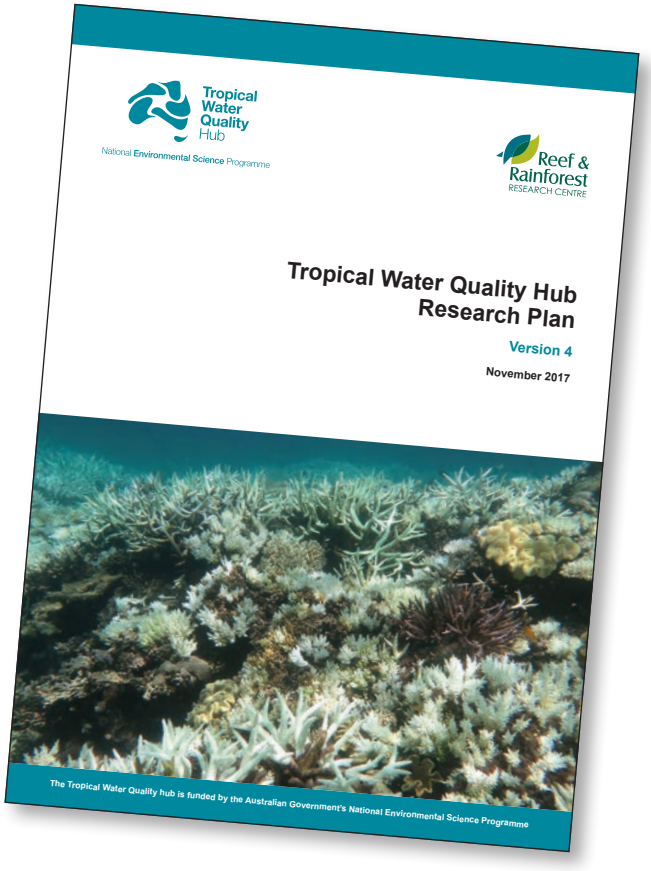

Papua New Guinea
Treaty Villages
Torres Strait
NESP Tropical Water Quality Hub - Area of Operation
NESP Tropical Water Quality Hub - Research Sites
Crown Of Thorns Control Program - Area of Operation
Building Resilience in Treaty Villages - Area of Operation
Reef Havens Research Project
Normanby Station
Lizard Island
Springvale Station
Karumba
Cairns
Strathalbyn Station
Bowen
Mackay
Gladstone
Bundaberg
Brisbane

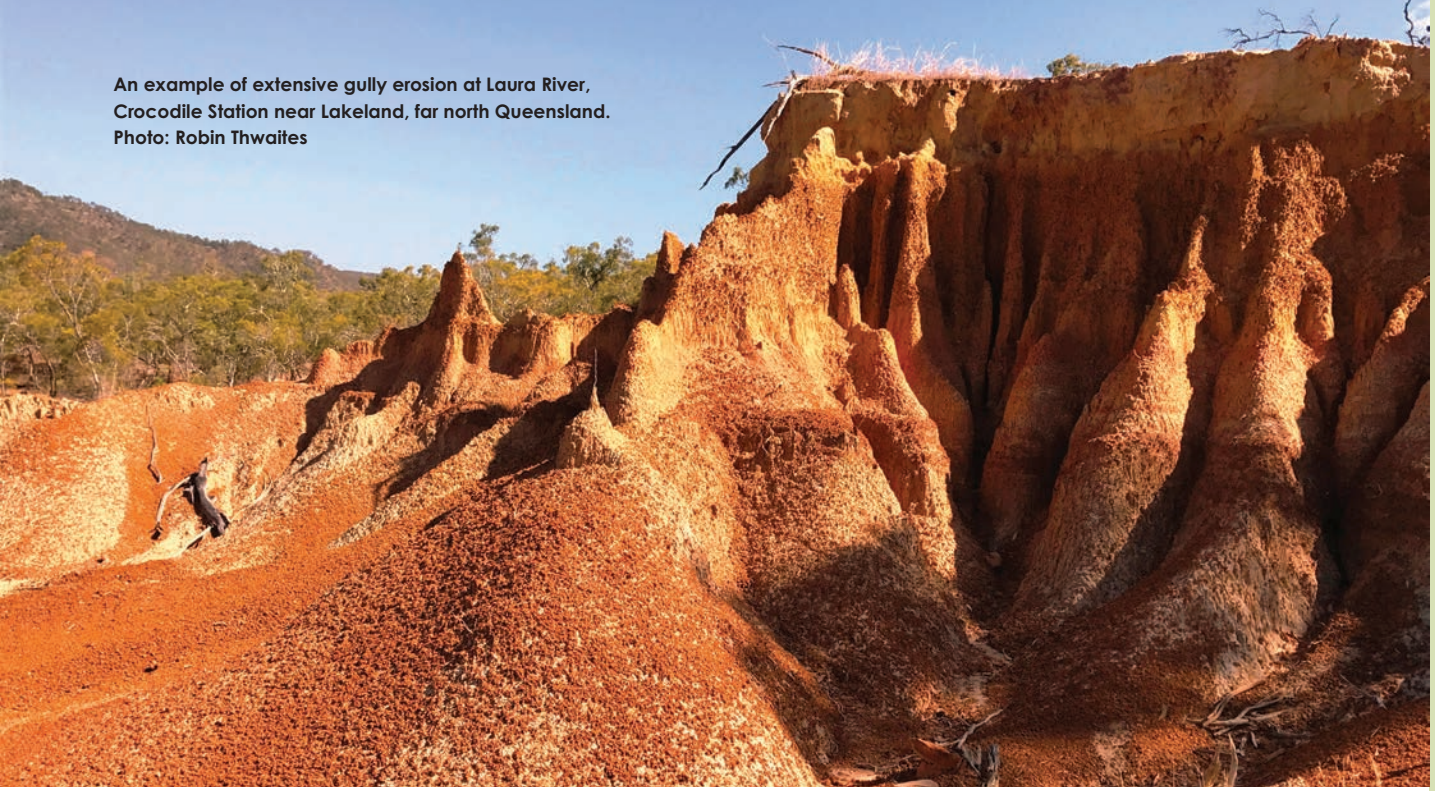
National Environmental Science Program's Tropical Water Quality Hub

With a total value of $64 million (2015-2021), the Tropical Water Quality Hub (TWQ) is the largest of the research hubs funded by the Australian Government's National Environmental Science Program. Hosted by RRRC, with Prof Damien Burrows from JCU as the Science Leader, the Hub supports over 220 researchers from six partner research institutions working to improve understanding of water quality and coastal management for the Great Barrier Reef. The focus is on collaborative research that delivers accessible results and informs decision-making by stakeholders. The Hub has an independent Hub Steering Committee of key stakeholders and is led by Leith Boully. The Steering Committee reports directly to the Department of the Environment and Energy.

Like many reefs around the world, the Great Barrier Reef is suffering from the combined effects of many threats and disturbances, including mass coral bleaching, pollution, storm damage, and outbreaks of pests like Crown-of-Thorns starfish, among others. While some of these threats are caused or exacerbated by global issues such as climate change, others may be amenable to local or regional-scale intervention, restoration and management. The approval of Hub Research Plan for 2018-19 has brought the total number of projects funded through the Hub to date to 86. Our Hub researchers and stakeholders continued to work closely together to address the regional drivers of health impacts on the reef, such as high sediment and nitrogen levels in runoff from coastal catchments. Close relationships with farmers and industry are critical to achieving these outcomes, and engagement frameworks and trust being built are proving to be key to the success of these projects. This capacity for sustained, meaningful two-way engagement between researchers and stakeholders continues to be a strength of the TWQ Hub.

More than 75 publications are now available on the TWQ Hub website. The current round of research projects builds on successful world-class research into factors affecting water quality in Australia's northern marine ecosystems, including the Great Barrier Reef. Research Plan 2018-19 focuses on cross-integrating and scaling up research from the previous four research plans. This includes applying the Crown-of-Thorns Starfish Integrated Pest Management Strategy and Decision Support Tools (DSTs) to an expanded fleet of control vessels, deeper understanding and communications of the spatial variability of coral bleaching, using Big Data to build a scientifically robust program to monitor the aesthetic value of the Great Barrier Reef (underpinning the $6 billion-per-year tourism industry it supports), gully remediation techniques, behaviour change and much more. A full list of the projects is available on the **NESP TWQ** Hub website.





An example of extensive gully erosion at Laura River, Crocodile Station near Lakeland, far north Queensland.
Photo: Robin Thwaites

Sample of publications produced for the NESP TWQ Hub in 2018-2019

Tropical Water Quality Hub

National Environmental Science Programme

$64.78m

over 6 years

$31.98m

Australian Government funding

$32.8m

co-contributions (cash and in-kind) to end 2018

86

projects approved funding as at end 2018

6

key partner research institutions

JCU, AIMS, CSIRO, CQU, UQ & GU

60

end user organisations

275

researchers as at end 2018

Building Resilience in Treaty Villages

The Building Resilience in Treaty Villages (BRTV) project funded by the Australian Department of Foreign Affairs and Trade (DFAT) is working with all 13 Treaty Villages in the South Fly District of Western Province, Papua New Guinea. This border region is of strategic importance to Australia under the Torres Strait Treaty and there are close family ties between the villagers and the Torres Strait and Cape York communities. RRRC is delivering this project for DFAT and their in-country partners Abt Associates.

The PNG Treaty Villages experience seasonal flooding, extended drought periods, high water tables, extreme coastal erosion, sea level rise and lack of infrastructure, all of which present operational barriers to enabling improvements in healthcare, clean water, sanitation and hygiene. The 'change to resilience' framework developed by this project is based on the successful Land and Sea Ranger programs in action across northern Australia over the last decade. The experience and lessons learnt from the Australian Ranger programs has informed both the theory and the practical implementation of the project.

This program has been running on Papua New Guinea border since 2013 and has been proven to be highly successful and cost effective. On-ground training and logistics support is provided by Cairns-based group INLOC International who are extremely experienced in delivery of remote area services. To this strong operational platform, the RRRC adds science and technical advances that have been developed in our region to enable improvements to be delivered in the communities where it is needed. Candidate rangers are nominated by their own communities and graduate after an 8-month training period as fully-fledged Community Rangers. One indication of the success of the program to date has been the remarkable 100% retention of trainees as Rangers following graduation.

This year this program focused on improving local governance and leadership through the delivery of a range of skills such as computer literacy, adult literacy and financial literacy training. The aim is for these skills to be transferable to village leaders in particular (as well as the general community) to assist the Ward Development Committees to draft and finalise Ward Development Plans and improve community development. These skills are already assisting in the establishment of new microbusinesses in the Treaty Villages.

Rangers are now recognised as a sector on the Ward Development Committees next to health, education, infrastructure and economic sectors, and are leading disaster response preparation plans for their respective Villages. A Leadership Group consisting of all Senior Rangers, three female Ranger Support Officers and selected male and female group second-in-charge Rangers are now the main recipients of leadership training and consultation, using this knowledge to mentor other Rangers and improve their confidence to discuss issues with community leaders and members.

The outstanding success of this program was again recognised in May 2019, when RRRC was notified that there would be another 12-month extension of funding for activities in the Treaty Villages.

Tureture Senior Ranger Vali teaches youth to make school furniture.

Nuku trainees assemble tank rings. Photos: INLOC

13 Treaty Villages

34 Female Community Rangers

76 Male Community Rangers

10 Ranger Support Officers (disabled)

1.3 Million litres of water-holding capacity

11 New wells

75 Urinary Diversion Dry Toilets (UDDT) constructed & installed

14 Food drying/smoking facilities built

2 Microbusinesses providing economic opportunities

52 Community members taught literacy, numeracy, typing

Constructing toilets. Photos: INLOC

Rangers Mathew, Kuki and Eabi adjust the saw mill. Photo: INLOC

Timber milling, a community-owned micro-business

Community Rangers from Sui, Parama, Mabaduan, Sigabaduru, Tureture, Tais, Mari, Jarais and Bula completed their warranty mandated timber milling training in 2018-2019. Having the skills for milling will help progress the Ranger Family Toilet business in meeting their order for 100 toilets. The training has not only taught the Rangers the proper operational procedures to follow in milling, but also mill maintenance, timber selection and timber storage.

Coupled with carpentry skills training, the Community Rangers have been constructing school furniture and are planning and designing community infrastructure as agreed by the Ward Development Committee for Women's Resource Centres and village foot bridges. The sustainability of timber supplies will be a focus in the following year with plans for nursery production.

BRTV Instructor Andy training Mabuduan Rangers Sereu and Tuwe in milling. Photo: INLOC

Western Province, PNG Treaty Village Rangers and communities designed their own badges

Crown-of-thorns Starfish Control Program

Crown-of-thorns starfish (COTS) are specialist hard coral feeders that occur naturally on reefs in the Indo-Pacific region, including the Great Barrier Reef (GBR). Populations of COTS are known to fluctuate between low and very high densities- known as 'outbreaks'. These outbreaks can result in substantial impacts on reef biodiversity through the loss of reef structure, the subsequent cascading effects on reef ecosystems, as well as significant economic (tourism) revenue loss. The GBR is currently in its ninth year of the fourth known COTS outbreak.

The Great Barrier Reef Marine Park Authority's Control Program aims to protect a network of priority coral reefs in the Marine Park from COTS outbreaks. The 2018 to 2019 financial year is the fifth year that RRRC has been involved in COTS control on the GBR, while our subcontractors AMPTO (Association of Marine Park Tourism Operators) have been engaged in COTS control activities for over fifteen years. During this financial year the third vessel, MV Tura, joined MV Hero and MV Venus II in coordinated surveillance, reef health and culling activities at 42 priority reefs between the Cape Tribulation and Townsville region.

Since 2015, the RRRC has driven the National Environmental Science Program (NESP) Tropical Water Quality Hub (TWQ) to develop an innovative and systematic approach to managing COTS outbreaks based on the principles of Integrated Pest Management (IPM). The selection of priority reefs for IPM is based on an individual reefs' relative economic and economic value, likelihood of being a COTS larvae sink, current hard coral and COTS outbreak status, as well as the operational capacity for effective control.

Implementation of the new IPM-based methodologies for on-water decision making progressed during this financial year. Improved incorporation of surveillance data into both voyage and culling planning at sites and reefs has increased the effectiveness and efficiency of COTS control efforts during this reporting period. Of the 42 high value priority reefs that RRRC and AMPTO managed between Cape Tribulation and Townsville in 2018-2019:

- 29 priority reefs were managed to 'no outbreak' status, at which coral growth outpaces COTS predation
- 50% of the highest (top ten) priority reefs have significantly improved in COTS outbreak status

During this financial year COTS control operations delivered by RRRC and AMPTO continued to incorporate a highly successful youth employment program through the Queensland Government's Skilling Queenslanders

for Work Program. This program has a proven high retention rate of full-time and continuous employment of COTS control graduates within the marine and tourism industries. Over 50% of the COTS control trainees are Indigenous and their involvement in the Program has resulted in positive life changing experiences at both an individual and a community level. AMPTO also delivers training and ongoing support to members of the marine tourism industry toward capacity building, joint management and control engagement by the end users.

Female crown-of-thorns control diver conducting Reef Health & Impact Survey for coral cover. Photo: Suzanne Long

Collecting scientific samples of starfish for collaborative research projects. Photo: Suzanne Long

3 COTS control vessels

72 ten-day voyages

652 days on-water completing COTS control activities

42 priority reefs visited

8,473 hours of dive time conducted

10,215 manta tows completed, covering **2,043** hectares of reef

1,365 RHIS (Reef Health and Impact Survey) completed, covering **10.7** hectares of reef

118,030 COTS culled across **8,359** hectares of reef

29 reefs managed from 'intensive' to 'maintenance' mode and from 'established' to 'no outbreak' status

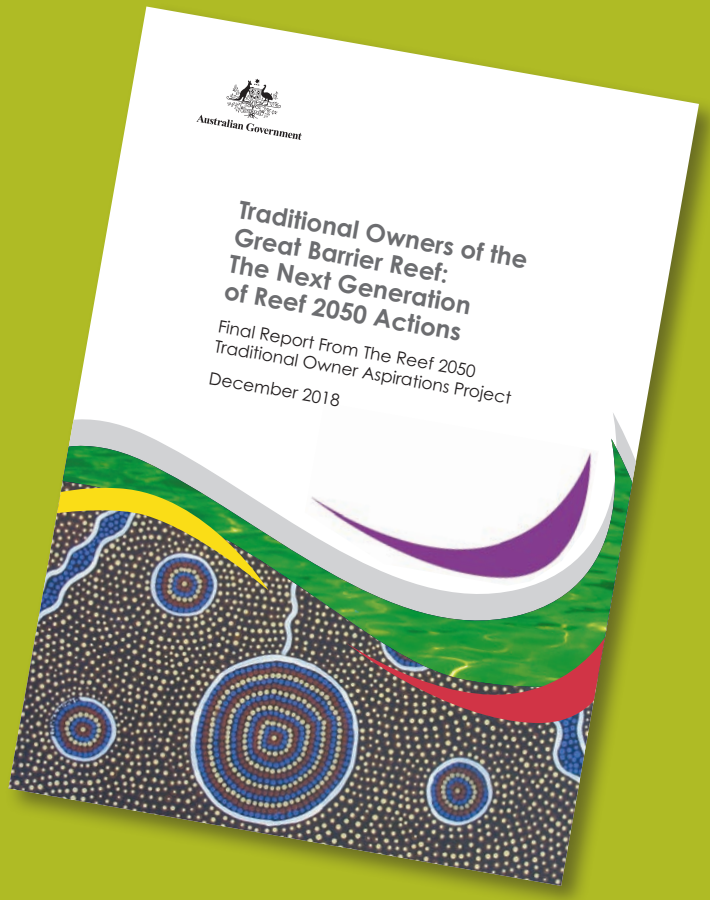
Provided approximately **121** hours to research support

Reef 2050 Traditional Owners Aspirations Program

There are at least 70 Traditional Owner (TO) groups with rights, interests and aspirations in sea country across the length of the Great Barrier Reef (GBR), stretching from the Burnett Mary region into the Torres Strait and spanning tribal, clan and family groupings. Traditional Owners of the Great Barrier Reef are bound to a set of inherent rights and interests that govern all ways of life on Country. The Reef 2050 Traditional Owner Aspirations Project hosted by RRRC and led by Traditional Owners aimed to better understand and reflect aspirations for the protection and management of the Great Barrier Reef and provide this input to improve the Reef 2050 Plan.

The project coordinated and consulted with Traditional Owners to make clear the priority actions and funding needed for Traditional Owner involvement in implementing the existing commitments under the Reef 2050 Plan. The Final Report, *Traditional Owners of the Great Barrier Reef: The Next Generation of Reef 2050 Actions* and a *Final Summary Factsheet* (publicly available via the project page on the RRRC website) provides 10 recommendations to advance a collective approach to achieving Traditional Owner rights and aspirations for ownership, access to, and involvement in the governance and management of sea country.

The findings from the report have been shared with GBR Traditional Owners.



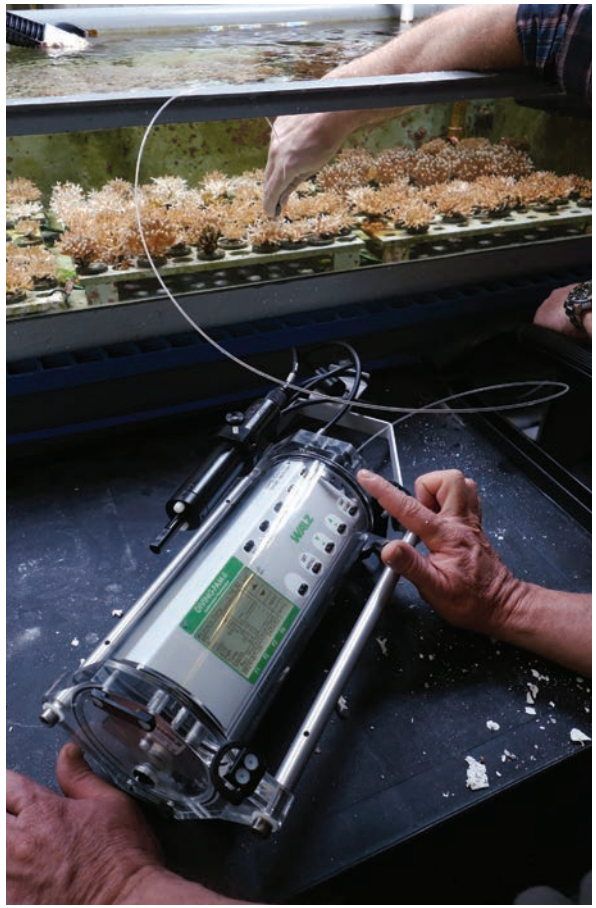
Some of the Traditional Owners discussing ways forward at the Palm Cove Forum; (R-L) Eddie Savage, Eddie Smallwood, Alan Dale, Duane Fraser, and Brian Johnson. Photo: Boyd Robertson

Reef Havens Research Project

The Reef Havens Research Project is funded by the Australian Government, with the support of the marine tourism industry and AIMS. Our collaborative in-situ research platform on the Great Barrier Reef at Moore Reef near Cairns is being used to increase understanding of local-scale coral bleaching and recovery, and evaluate the effectiveness of possible interventions with scientific rigour. A variety of instruments measuring temperature, flow and water column profiles have delivered ~400 million data points to date, which will shortly be made publicly available.

Fortunately the summer of 2018-19 was relatively benign and coral bleaching conditions did not occur at our site at Moore Reef. Nonetheless the team and in-sensor network continued to make valuable observations and these have enabled some important new insights into the fine-scale hydrodynamics of mass coral bleaching events on the GBR that had not previously been elucidated.

Analyses of data from the 2017 mass bleaching event suggest that bleaching is triggered by acute stress acting over a period of days as a result of local weather (specifically wind strength). While the Great Barrier Reef lagoon is generally well-mixed in terms of temperature through the water column due to wind acting on the water's surface, this mixing process begins to fail during periods of low (doldrum) winds. When a series of doldrum days occurs during summer, the water column begins to stratify, with the surface layer becoming unusually hot and the deeper water remaining at survivable temperature. Data collected during the heatwave in Nov/Dec 2018 show as much as 2°C difference in temperature between the surface and 12-14 m depth, and as much as 3°C difference between the surface and 20-25 m depth.



Measuring coral stress in the National Sea Simulator with AIMS and reef tourism staff. Photo: Suzanne Long

Our Engagement with Stakeholders

Innovative Nitrogen Use in Sugarcane Forum

The Innovative Nitrogen Use in Sugarcane Forum, hosted by RRRC and Canegrowers in November 2018, brought delegates and growers from across Queensland, from catchments ranging from Cape York to the Burdekin and Mackay/Whitsunday region. A space was provided for farmers and scientists to continue the conversation about the role of nitrogen use in sugar cane farming and the best methods for limiting runoff. Matt Kealley, CANEGROWERS Senior Manager for Membership and Innovation, said limiting nitrogen runoff was important for both the health of the Great Barrier Reef and the farmers' businesses. "In the last five years, both the cane industry and the NESP Tropical Water Quality Hub have made tremendous strides in science and research underpinning practices to improve the effective use of nitrogen in farming," he said.

Providing a worthwhile event that is enticing to growers can be challenging, however the 2018 Forum attracted enough growers to make up 25% of the 130 delegates, larger than any other representative group attending. Presentations included new techniques in on-farm nitrogen management and planning, developments in extended efficiency fertilizer, nitrogen management prediction, as well as real-time monitoring of catchments to promote behavioural change. Delegates were also given the opportunity to respond to presentations, interact with the project leaders and provide workshop input to refine the direction that agriculture, science and management will use to address the ongoing progress in reaching dissolved organic nitrogen targets.

Overall, feedback from the event showed that the current research into nitrogen is garnering positive feedback from both grower and industry. 50% of the room felt good about current directions and results, 47% felt satisfied, with only 6% communicating an opposing sentiment. Unanimously, the conference indicated that continued engagement and adoption of innovative management tools and practices with growers will be the only way for the cane industry to remain productive whilst also achieving the minimum standards required to maintain water quality on the Great Barrier Reef.

> *"Increasingly, we hear the concerns about the impact of farming on the Reef. To be honest, we believe some of it but most of the reports we are sceptical about... I can tell you that very few farmers believe the modelling... However it would be totally wrong to say that we are not committed to improving our region and want it to be the best it can be... Unless the [water quality science] strategies are practical and sensible for our region and are well-understood by growers – then they will fail.*
>
> *"[NESP TWQ Hub's] Project 25 allows us to monitor the catchment in real-time. More importantly, it allows us to place the automatic monitors where we believe we needed the information.... A big effort was made for us to see the results quickly, without the information being used against us. We can now see where the problems are and where they are not...*
>
> *"Now we can monitor, we can track the problems down rather than just blame everyone and give the whole farming community a bad name."*
>
> **Barry Stubbs, Cane grower**

Decision-makers Reef Trip

Decision-makers involved in the Australian government's National Environmental Science Program (NESP) saw the recovery of corals on the Great Barrier Reef first-hand in May 2019. The group, which included representatives from the Australian and Queensland Governments, the agricultural industries, the RRRC and senior researchers, serve as the Steering Committee of the NESP Tropical Water Quality Hub. RRRC partnered with Frankland Islands Reef Cruises to transport the NESP committee down the rainforest-lined Russell River, then out for a snorkel tour of the Frankland Islands' fringing reefs about 10 kilometres from the mainland. These reefs were hit particularly hard during the 2016 & 2017 mass bleaching events but are now showing very positive signs of recovery from bleaching in addition to the growth of new juvenile corals. Frankland Island Reef Cruises co-owner Elouise Collins hoped the trip would help counter media narratives about the supposed death of the entire Great Barrier Reef. Ms Collins, an environmental scientist with 15 years' experience, said that the international discussion on the health of the Great Barrier Reef had failed to include enough detail on corals' ability to resist and recover from damage. "People have been led to believe that the entire reef is dying, but anyone with an inkling of the science understands that corals can change and adapt – the reef is clearly not dead," she said.

Then and now: corals around the Frankland Islands were severely affected during the 2016 and 2017 mass bleaching events (left). While many corals died at that time, the many survivors are now thriving (right), making the Frankland Islands an excellent snorkelling experience for visitors to the Great Barrier Reef. Photo: Suzanne Long

Decision-makers from the Australian Government's National Environmental Science Program visiting the Frankland Islands to inspect reef recovery. Photo: Boyd Robertson

Healthy corals that survived the bleaching events thriving on the reefs around the Frankland Islands, Great Barrier Reef, in May 2019. Photo: Suzanne Long

Palm Island community shows keen interest in Community Ranger pilot

It has been proposed that community-driven ranger development principles that have proven to be very successful in high-challenge communities in PNG could be applied in Australia. More than 50 people including Manbarra Traditional Owners and a number of Bwgcolman youth turned up to a Community Ranger workshop on Palm Island in April 2019 where organisers demonstrated some of the skills that future Palm Island Community Rangers could learn, including SCUBA use, welding, nautical rope skills and Crown of Thorns Starfish control. Attendees were highly enthusiastic about the program's possible benefits and community-driven approach. "We love our reef, we rely on it," said lifelong Palm Island resident Moa Sam. "From what we saw here today about this program, my only real question is 'where do we sign up?" This pilot program is funded by Portland House Group and RRRC.

Partners & Stakeholders

Abt Associates Pty Ltd
Advance Cairns
AgForce
Association of Marine Park Tourism Operators
Australian Fisheries Management Authority
Australian Institute of Marine Science
Australian Museum
Australian National University
Australian Tropical Herbarium
Balkanu Corporation
BHP Billiton
Biosecurity Queensland
Bottoms English Lawyers
Burnett Mary Region Group
C_2O Consulting
Cairns Aquarium
Cairns Regional Council
CANEGROWERS
Cape York NRM
Cape York Partnership
Cape York Sustainable Futures
Cassowary Coast Regional Council
Central Queensland University
Citizens of the Great Barrier Reef Foundation
CSIRO
Dawul Waru Aboriginal Corporation
Department of Agriculture and Water Resources
Department of Foreign Affairs and Trade
Department of Prime Minister and Cabinet
Department of Environment and Energy
Experience Co.
Far North Queensland & Torres Strait Regional Development Australia
Far North Queensland Regional Organisation of Councils
Farmacist
Fertiliser Australia
Fitzroy Basin Association
GemPearl
Gidarjil Development Corporation
Girringun Aboriginal Corporation
Gladstone Healthy Harbour Partnership
Gladstone Ports Corporation
Glencore
Great Barrier Reef Foundation
Great Barrier Reef Marine Park Authority
Greening Australia
Griffith University
Growcom
INLOC
Integrated Marine Observing System
Jabalbina Yalanji Aboriginal Corporation
James Cook University

Juvenile cassowary on the road at Mission Beach, Wet Tropics. Photo: Suzanne Long

MacDonnells Law

Mandingalbay Yidinji Aboriginal Corporation

Marino Lawyers

Meat and Livestock Association

Muugar Saltwater Foundation

North Australian Indigenous Land and Sea Management Alliance Ltd

North Queensland Bulk Ports

NQ Dry Tropics

Port of Townsville

Portland House Foundation

Ports Corporation of Queensland

Ports North

Powerlink

Projects Global

Queensland Department of Aboriginal and Torres Strait Islander Partnerships

Queensland Department of Agriculture and Fisheries

Queensland Department of Environment and Science

Queensland Department of Health

Queensland Department of Main Roads

Queensland Department of National Parks, Sport and Racing

Queensland Department of Natural Resources and Mines

Queensland Department of Premier and Cabinet

Queensland Department of Science, Information Technology and Innovation

Queensland Department of State Development

Queensland Farmers Federation

Queensland Health

Queensland Ports Association

Queensland Seafood Industry Association

Queensland Tourism Industry Council

Quicksilver Group

Reef Catchments NRM

Reef Check

Reef Restoration Foundation

Reef Water Quality Partnerships

Rio Tinto

Skyrail Rainforest Foundation

Southern Cross University

Sugar Research Australia

Sunfish

Surf Life Saving Queensland

Terrain NRM Ltd

Terrestrial Ecosystem Research Network

Torres Shire Council

Torres Strait Islands Regional Council

Torres Strait Regional Authority

Tourism and Events Queensland

Tourism Tropical North Queensland

Townsville City Council

Townsville Enterprise Limited

Treaty Village Association, PNG

University of Melbourne

University of New South Wales

University of Queensland

Wet Tropics Management Authority

World Wildlife Fund

Our Impact

At RRRC we believe our impact should be measured in more than just funding invested, projects delivered and scientific papers published. To achieve our long-term strategic goals of building research capacity and knowledge for a more ecologically and socially sustainable north Queensland region, we ensure the research we broker, manage and translate is driven by the needs of stakeholders and delivered to them in useful forms.

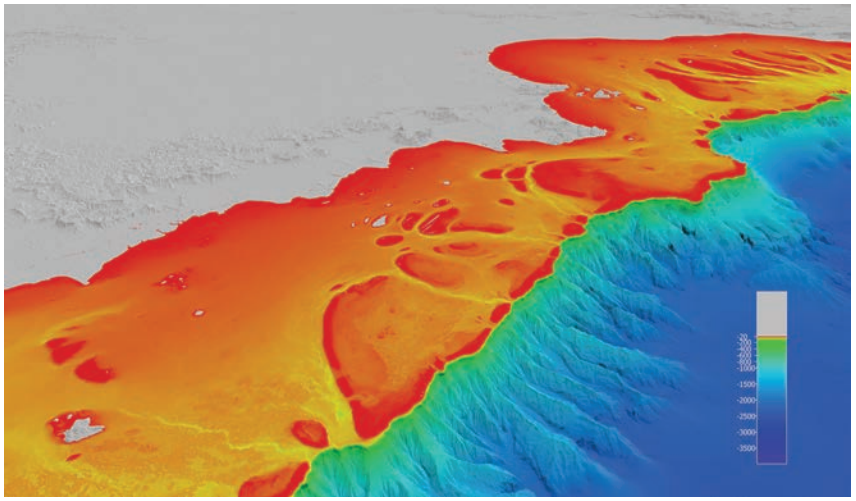
Obviously such impacts take time to achieve and demonstrate, and RRRC has been pursuing these goals for over ten years. The following section highlights just a few standout examples that have come to our attention this year, arising from our work through the Australian government's Marine and Tropical Sciences Research Facility (MTSRF, 2006-2010), the National Environmental Research Programme's Tropical Ecosystems Hub (NERP TE, 2011-2014), and the National Environmental Science Program's Tropical Water Quality Hub (NESP TWQ, 2015-2021), among many other programs.

High-resolution depth model for the Great Barrier Reef and Coral Sea

In 2009, RRRC contributed to an ambitious new project to develop a high-resolution depth model for the Great Barrier Reef and Coral Sea. Led by Dr Robin Beaman from JCU, the project sought to address the critical lack of information about the location and extent of deep-water ecosystems and seabed habitats for about a third of the Great Barrier Reef World Heritage Area that lies deeper than 200 m. In addition, much of the inter-reef (between reefs) seabed shallower than 100 m on the Great Barrier Reef shelf, and many of the shallow corals reefs themselves, had never been adequately mapped using modern techniques.

Thanks to close collaboration with the Australian Hydrographic Office and Royal Australian Navy, the resultant publicly-available 3D seabed map of the Great Barrier Reef and Coral Sea has been used as a fundamentally important mapping tool by managers, marine scientists and many others. It's even won awards (Queensland Spatial Excellence Awards, 2014). The 100-metre resolution gridded bathymetry dataset covers an area of about 3,000,000 km^2, from the Gulf of Papua to northern New South Wales, and easterly into the deep Coral Sea. It is available for public download in a range of forms from the website **www.deepreef.org**.

"The grid has been used by industry, government and research institutes, as well as the general public for understanding many issues on the Great Barrier Reef, such as freshwater plume tracking, seabed habitat and storm surge modelling," Dr Beaman said. "Nearly every week I receive a call with a new idea on how the grid can be used and many of these applications go far beyond my imagination for its use."



Screencapture of the Deepreef.org 3D depth model for the Cape York region, looking north-west (Lizard Island at bottom left). Courtesy of Robin Beaman

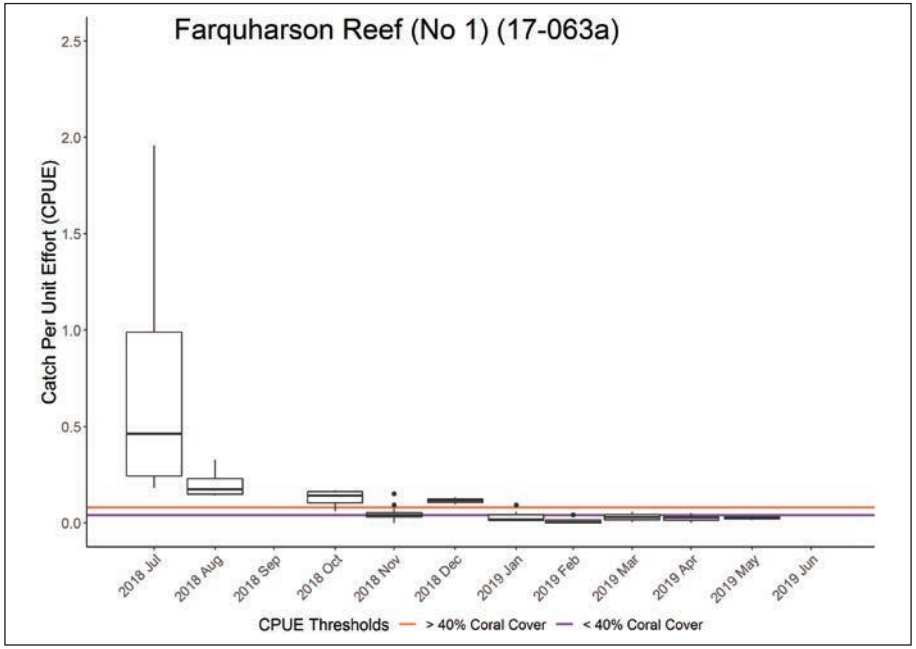
In the past year alone, the grid has been used extensively by GBRMPA's **2019 Outlook Report** and also as part of a **NESP TWQ-commissioned study** into whether crown-of-thorns starfish are likely to inhabit deep reef areas.

COTS control works: the Integrated Pest Management approach is defending live coral cover

Integrated Pest Management (IPM) is a well-established approach to pest management on land, but the application of its principles to trying to control coral-eating crown-of-thorns starfish (COTS) is an innovative world first that has been driven by RRRC. This approach aims to deliver the most efficient and effective control of the pest – and live coral saved - for the resources available, and enables control programs to evolve in efficiency and effectiveness over time as knowledge gaps are filled and tools are developed. Coordinated through NESP TWQ and led by CSIRO, researchers from CSIRO, AIMS, JCU and UQ are actively investigating improvements and new approaches including new technologies and strategies for surveillance and control. Many of these strategies have already been taken up by the control program and GBRMPA is ensuring all new COTS control vessels use the IPM approach/ recommendations. As a result, by mid-2019 there were numerous examples of individual high-priority reefs that had been successfully reduced to "no-outbreak" status – an ecological threshold at which coral growth can outpace starfish predation - by crews implementing the recommendations from the IPM research program.

Can we stop the current outbreak? No, but the data show we can defend ecologically and economically important sites, and possibly entire reefs. Can we reduce the impact of the current outbreak? Yes, we can protect coral cover at ecologically important sites. Further research to guide and optimise control effort is currently underway and offers the hope that ecologically meaningful moderation of the impact of the current outbreak will be possible. Can we stop future outbreaks through improved water quality? This would be ideal, however the substantial pollution reductions that would be required to prevent outbreaks occurring are yet to be achieved, and despite significant investment no change in Reef water quality has been measured.

Manual control of COTS is currently the ONLY action we can take that demonstrably defends and improves live coral cover on the Great Barrier Reef. With continuous improvement in control methods and strategies we can have ongoing, direct and immediate positive impact on live coral cover on the Great Barrier Reef.

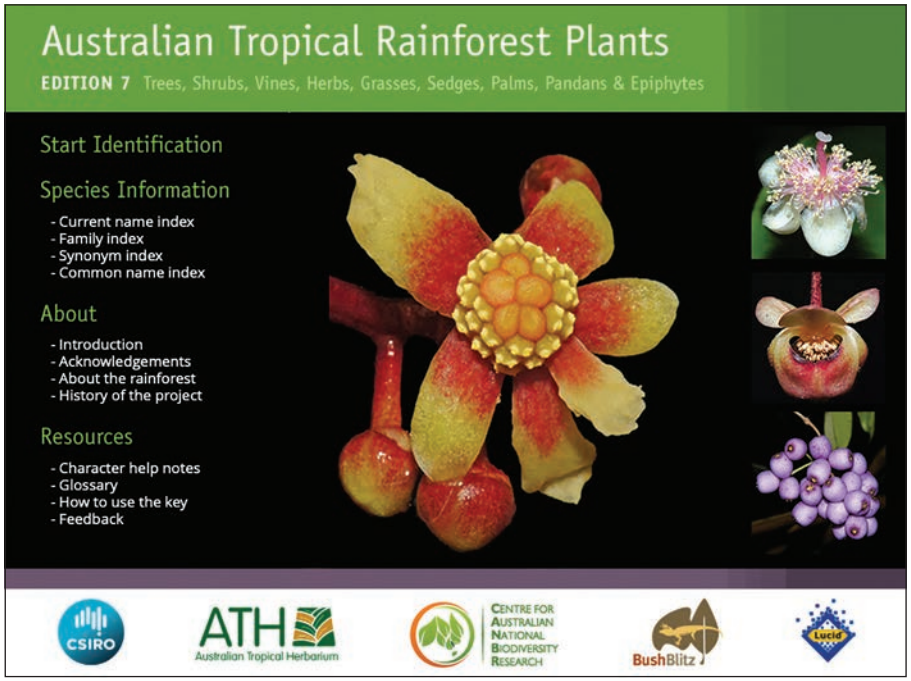


Rapid real-world impact of research: COTS densities (as estimated by catch per unit effort, or CPUE) on Farquharson Reef declined rapidly following on-water implementation of recommendations delivered from the NESP TWQ Integrated Pest Management research program. As a result this reef was declared to be "no-outbreak" by mid-2019, meaning that coral growth can outpace starfish predation. This graph was collaboratively produced by AMPTO, RRRC and GBRMPA.

Investment in Wet Tropics plant biodiversity identification tool bearing fruit for businesses

How to identify plants in one of the most biodiverse rainforests on earth? Specialists from a wide range of institutions have toiled for over 50 years to generate taxonomic keys for a range of Wet Tropics plant groups. In 2009, MTSRF funding contributed to the Australian Tropical Herbarium incorporating all vascular plants found in Wet Tropics rainforest habitats into a single taxonomic key, at that time a unique achievement for any rainforest in the world. This invaluable tool for managers, scientists and decision makers was then made available online in 2010 (Edition 6) with the aim of enabling as many people as possible to simply and accurately identify and learn about plants in Australia's tropical rainforests. In March 2019 **Edition 7** was released, now hosted by the **Centre for Australian National Biodiversity Research** and covering 2,753 species of trees, shrubs and vines, grasses, sedges, palms, pandans and epiphytes of northern Australian rainforests, with an extension to include the rainforests of coastal central Queensland from Townsville to Rockhampton. A total of 173 characters, covering morphology – habit, bark, leaves, flowers, fruits and seedlings and some geographic and ecological information ensure reliability and power of the key is high.

Since the key has been made available online, it has received in the order of 800-900 unique visitors per month. One of them is Ryan Hughes, a professional ecologist from the Cairns-based business 4 Elements Consulting, who works on a range of projects involving environmental impact assessments in the Wet Tropics. "This key is the most useful resource that is available to me, and it is free," he said. "I also use it as a primary resource to provide training to younger professional ecologists looking to increase their knowledge in plant identification."



U.S. coral restoration symposium builds on TWQ Hub research

The Reef Futures 2018 Symposium in Key Largo, Florida brought together coral restoration experts from around the world, including Tropical Water Quality Hub researchers.

An American follow-up to the inaugural Great Barrier Reef Restoration Symposium held in Cairns in July, Reef Futures 2018 had multiple speakers from that event, including TWQ researchers Dr Line Bay, David Westcott and Cameron Fletcher, Boze Hancock from The Nature Conservancy, and David Gulko from the Hawaii Division of Aquatic Resources. Reef Futures built on much of the groundwork laid by the Great Barrier Reef Restoration Symposium with a similar focus on innovation and applicability, featuring sessions on restoration genetics, drone monitoring, coral microfragmentation, restoration scaling, stakeholder engagement and more.

Huge improvement in water quality at Strathalbyn Station thanks to gully remediation research

The results from NESP TWQ-funded research into the effectiveness of innovative rehabilitation techniques have contributed to gully erosion works undertaken by Greening Australia for their 'Innovative Gully Remediation Project' on Strathalbyn Station, a grazing property three hours south of Townsville. Greening Australia Program Adviser, Lynise Wearne, noted that the gullies targeted at Strathalbyn Station have exported an average 956 tonnes per hectare per year since 1945. This equates to a staggering 550,000 tonnes of sediment to the Burdekin over that period, of which at least 65% is capable of reaching the Great Barrier Reef (based on analysis from Prof Andrew Brooks, Griffith University). In May 2018, Greening Australia announced that phase one of their gully restoration works had improved the sediment concentration leaving the treatment gully by 97%. Based on this success, Greening Australia now plans to roll out the techniques used at Strathalbyn Station to erosion hotspots elsewhere along the Reef. The 'Innovative Gully Remediation Project' is a collaborative project supported by the Queensland Government's Reef Innovation Fund and Greening Australia's Reef Aid™ Program.

Greening Australia CEO Brendan Foran with landholder Bristow at Strathalbyn Station, where the gully erosion works were trialled. Photo courtesy of Greening Australia

Intervention helps restore viability at popular Whitsundays reef

The thriving inshore reefs at Manta Ray Bay in the Whitsunday Islands were one of the region's most popular snorkelling sites until Severe Tropical Cyclone Debbie virtually demolished them in March 2017. Tourism Whitsundays Chair Al Grundy said the bay had hosted "the most amazing corals" before the cyclone hit. Huge centuries-old boulder-shaped corals called *Porites* and their surrounding fish were the main attraction.

"After Cyclone Debbie came along, we found the *Porites* had literally been ripped out and rolled up toward the beach onto the flat," he said. "We couldn't really get boats in to the beach any more and the reefs were gone. Everything else was just rubble. So it looked like a total loss."

Al Grundy appealed to the Queensland Parks and Wildlife Service (QPWS) for help in restoring Manta Ray Bay. After a rigorous project assessment the bold decision was made to return 400 tonnes of bommies to the reef. The collaborative project cost about $30,000 and was funded by QPWS under the Tropical Cyclone Debbie recovery fund.

Did it work? Sixteen months later, a team working to evaluate the effectiveness of various reef restoration efforts as part of a NESP TWQ project conducted a rapid ecological survey of the repositioned *Porites* bommies. They found promising signs of recovery, including partially surviving *Porites* colonies, new coral recruits and thriving fish populations. Importantly, tourism visitation to Manta Ray Bay had also resumed. Their survey findings including recommendations for future post-cyclone reef interventions have been published in the journal Ecological Management and Restoration.

Al Grundy said the restoration works meant that the island's reefs were 'like a phoenix, rising from the ashes'. "We've seen this economic benefit return to the region, also the private visits are back so there is that social benefit as well," he said. "I think this a great example of how there is this changing attitude toward reef restoration projects. Even if it's on a relatively small scale like this, when it comes to reefs, sitting on our hands just isn't an option anymore."

Making data freely available to all – a decade of the eAtlas

One of the biggest issues with environmental research data, which is expensive to collect and only grows more valuable over time, is maintaining accessibility for everyone once the project finishes. Often the datasets are left languishing in someone's filing cabinet and thus can't be used by others. Acknowledging this problem, during the MTSRF the RRRC championed development of the **eAtlas**, a high-quality online repository of information on northern Australia's tropical and marine ecosystems. Now hosted by AIMS, over 900 GB of raw data is currently hosted on the eAtlas, including huge databases on water quality, satellite imagery, temperature trends and more, from many different research programs including the Marine Monitoring Program, the NERP TE and the NESP TWQ Hub. Importantly, all of this information is freely available to all.

A rigorous dedication to quality control has made the eAtlas an 'example of how things should be done' according to Research Data Australia. It is a highly sought-after and utilized resource, with 24,000 unique visitors to the site (mainly members of the public) over a 90-day period considered 'fairly normal' by administrator Dr Eric Lawrey at the Australian Institute of Marine Science (AIMS).

"I'll go to conferences and see presentations with data that only could have come from eAtlas all the time," Dr Lawrey said. "We go through quite a process to ensure good quality data - recently we just removed over 1000 map layers because they had insufficient metadata, but we have added over 2500 layers from the Queensland Government, Geoscience Australia and the Atlas of Living Australia with good quality metadata.

"We go through all received data and really try to interrogate it – that is, to think of and ask all the questions that someone might have about this dataset – and then we work with the researchers to address any gaps that are found. We also make sure there's good preview ability for datasets, this is a big factor in usability because it means researchers can quickly assess datasets to determine if this is the information they need."

500,000 visitors to Cairns Aquarium informed by RRRC-associated research

The opening of the Cairns Aquarium in September 2017 provided an outstanding opportunity for transfer of knowledge about the region to a potentially huge audience. Over ten years of integrated rainforest, catchment and reef research conducted through the MTSRF, NERP TE and NESP TWQ combined meant that RRRC was in a unique position to assist the Cairns Aquarium in developing educational and engaging signage for each of their exhibits.

"The interpretive signage at Cairns Aquarium developed in partnership with RRRC is providing an engaging and educational narrative for visitors to the Aquarium, describing the key ecological species and linkages as water travels from rainforest catchments into the Great Barrier Reef," said Daniel Leipnik, Cairns Aquarium CEO. "Since we opened over 500,000 visitors have been able to interact with the information RRRC has provided, deepening their understanding of regional north Queensland and its unique environmental assets."

Visitors to the Cairns Aquarium interact with a wide range of interpretive signage providing insights into the linkages between species and ecosystems, impacts of climate change, water quality and many other issues that are past or current topics of research programs associated with RRRC. Visitors can share their new understanding and appreciation within their networks, further increasing impact locally, nationally and abroad.

Financial Summary

During 2018-19 RRRC's principle activities of the company consisted of administering the Australian Government contracts managed by the Department of the Environment & Energy (DOEE) to provide services for program management of, and communications services for the National Environmental Science Program (NESP) including administration of the NESP Tropical Water Quality Hub. Other significant activities included project management of implementation contracts for Crown of Thorns projects funded by the Department of the Environment & Energy and Great Barrier Reef Marine Park Authority (GBRMPA) and for the PNG Building Resilience in the Treaty Villages (BRTV) project funded by Abt Associates Pty Ltd.

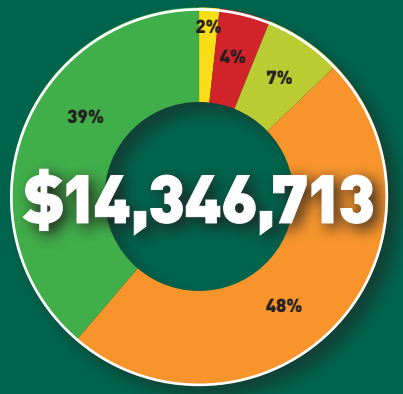
There were no other significant changes in the nature of the company's operations, being the provision of project management and administrator services for research and development activities.

Total income earned for 2018-19 was **$14,346,713**.

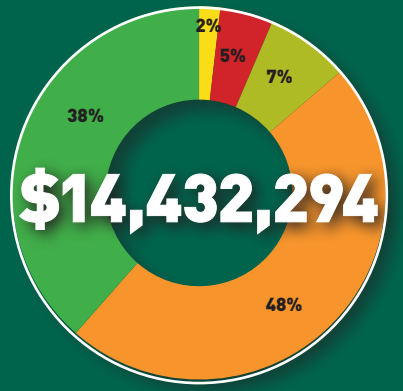
RRRC's expenditure in 2018-19 consisted of payments to research institutions for research contracts, payments to contractors for implementation contracts and corporate expenditure on project management activities including website development, knowledge brokering and communication, payroll, travel and general administrative overheads.

Total expenditure incurred in 2018-19 was **$14,432,294**.

Income by activity



Expenditure by activity



- Research contract activities
- Admin
- KB & Comms
- Implementation contract activities
- Other (inlcuding COTS, PNG & events)

Left: Surprisingly little is known of the factors influencing coral bleaching severity and recovery after bleaching. These corals at Moore Reef near Cairns bleached extensively in Feb/Mar 2017, but nearly all recovered; by the time of this photo in mid-2019, they were flourishing. However many others nearby on Moore Reef suffered high mortality after the 2017 bleaching event. Why? RRRC's Reef Havens Research Project at Moore Reef is looking into the influence of fine-scale hydrodynamics (water temperature and movement) on coral stress, bleaching and recovery. Photo: Suzanne Long

www.rrrc.org.au